

WHAT IS CLAIMED IS:

1. A manufacturing method of a semiconductor device in which wiring made of metal is formed of a single layer structure or a multilayer structure,

5 wherein an interlayer insulating film for electrically isolating the wirings from each other located above and below or side by side is formed of an SiOC film, and an insulating film having the difference in Young's modulus from said SiOC film of 50 GPa or less or the difference in stress from said
10 SiOC film of 50 MPa or less is formed so as to come into contact with said SiOC film.

2. A manufacturing method of a semiconductor device in which wiring made of metal is formed of a single layer structure or a
15 multilayer structure,

wherein an interlayer insulating film for electrically isolating the wirings from each other located above and below or side by side is formed of an SiOC film, an relatively thin SiCN film is formed on or below said SiOC film, and an SiC film
20 with a thickness of 5 nm or larger is interposed between said SiOC film and said SiCN film.

3. A manufacturing method of a semiconductor device in which wiring made of metal is comprised of a single layer structure
25 or a multilayer structure,

wherein an interlayer insulating film for electrically isolating the wirings from each other located above and below or side by side is formed of an SiOC film which contains nitrogen, and a relatively thin SiCN film is formed so as to

come into contact with said SiOC film.

4. A semiconductor device in which metal wiring is formed in trenches formed in an interlayer insulating film on a semiconductor substrate and a cap insulating film for preventing the diffusion of the metal which constitutes said wiring is formed over each of said interlayer insulating film and said metal wiring,

wherein said interlayer insulating film is comprised of an SiOC film, an SiC film formed on said SiOC film, and an SiON film formed on said SiC film, and

said cap insulating film is comprised of an SiCN film and an SiC film formed on said SiCN film.

5. The semiconductor device according to claim 4,

wherein said SiON film which constitutes a part of said interlayer insulating film has the nitrogen content of 5 atoms% or less or the diffraction ratio of 1.495 or less.

6. The semiconductor device according to claim 4,

wherein a stopper insulating film functioning as an etching stopper when etching said interlayer insulating film to form said trenches is formed at the intermediate portion of said interlayer insulating film, and said stopper insulating film is comprised of an SiCN film and an SiC film formed on said SiCN film.

7. A semiconductor device in which metal wiring is formed in trenches formed in an interlayer insulating film on a

semiconductor substrate and a cap insulating film for preventing the diffusion of the metal which constitutes said wiring is formed over each of said interlayer insulating film and said metal wiring,

5 wherein said interlayer insulating film is comprised of an SiOC film and an SiON film formed on said SiOC film, and said cap insulating film is comprised of an SiCN film and an SiC film formed on said SiCN film.

10 8. The semiconductor device according to claim 7, wherein said SiON film which constitutes a part of said interlayer insulating film has the nitrogen content of 3 to 4 atoms% or less.

15 9. The semiconductor device according to claim 7, wherein said SiON film which constitutes a part of said interlayer insulating film has a diffraction ratio of 1.485 or less.

20 10. The semiconductor device according to claim 7, wherein a stopper insulating film functioning as an etching stopper when etching said interlayer insulating film to form said trenches is formed at the intermediate portion of said interlayer insulating film, and said stopper insulating
25 film is comprised of an SiCN film and an SiC film formed on said SiCN film.

11. A semiconductor device in which metal wiring is formed in trenches formed in an interlayer insulating film on a

semiconductor substrate and a cap insulating film for preventing the diffusion of the metal which constitutes said wiring is formed over each of said interlayer insulating film and said metal wiring,

5 wherein said interlayer insulating film is comprised of an SiOC film and an SiOCN film formed on said SiOC film, and

 said cap insulating film is comprised of an SiCN film and an SiC film formed on said SiCN film.

10 12. The semiconductor device according to claim 11,

 wherein said SiOC film which constitutes a part of said interlayer insulating film is a film having the change in stress of 50 MPa or less in the temperature range from room temperature to 450°C.

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13. The semiconductor device according to claim 11,

 wherein said SiOCN film which constitutes a part of said interlayer insulating film has the nitrogen content of 10 atoms% or less.

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14. The semiconductor device according to claim 11,

 wherein a stopper insulating film functioning as an etching stopper when etching said interlayer insulating film to form said trenches is formed at the intermediate portion of
25 said interlayer insulating film, and said stopper insulating film is comprised of an SiCN film and an SiC film formed on said SiCN film.

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15. A semiconductor device in which metal wiring is formed in

trenches formed in an interlayer insulating film on a semiconductor substrate and a cap insulating film for preventing the diffusion of the metal which constitutes said wiring is formed over each of said interlayer insulating film and said metal wiring,

wherein said interlayer insulating film is comprised of an SiOCN film, and

said cap insulating film is comprised of an SiCN film and an SiC film formed on said SiCN film.

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16. The semiconductor device according to claim 15,

wherein said interlayer insulating film is comprised of an SiOCN film and an SiON film formed on said SiOCN film.

15 17. The semiconductor device according to claim 15,

wherein said SiOCN film which constitutes said interlayer insulating film has the nitrogen content of 10 atoms% or less.

18. The semiconductor device according to claim 15,

20 wherein a stopper insulating film functioning as an etching stopper when etching said interlayer insulating film to form said trenches is formed at the intermediate portion of said interlayer insulating film, and said stopper insulating film is comprised of an SiCN film and an SiC film formed on
25 said SiCN film.

19. A manufacturing method of a semiconductor device in which metal wiring is formed in trenches formed in an interlayer insulating film on a semiconductor substrate and a cap

insulating film for preventing the diffusion of the metal which constitutes said wiring is formed over each of said interlayer insulating film and said metal wiring,

5 said interlayer insulating film is comprised of an SiOC film and an SiON film formed on said SiOC film, and

 said cap insulating film is comprised of an SiCN film and an SiC film formed on said SiCN film,

 wherein, after forming said SiOC film which constitutes a part of said interlayer insulating film, the plasma treatment
10 is performed to the surface of said SiOC film, and then, said SiON film is formed on said SiOC film.

20. The manufacturing method of a semiconductor device according to claim 19,

15 wherein said SiOC film which constitutes a part of said interlayer insulating film is deposited by the plasma CVD method at the temperature of 375°C.

21. The manufacturing method of a semiconductor device
20 according to claim 19,

 wherein said SiOC film which constitutes a part of said interlayer insulating film is deposited by the plasma CVD method so that the change in stress of the film is set to 50 MPa or less in the temperature range from the room temperature
25 to 450°C.